
DEPARTMENT OF THE ARMY 02241.TD
CORPS OF ENGINEERS, TULSA DISTRICT JAN 97
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TULSA DISTRICT GUIDE SPECIFICATION

SECTION 02241

AGGREGATE BASE COURSE

NOTE: This guide specification covers the requirements for base course for roads and streets and for airfield pavements designed for light loads, Type B and C traffic areas for medium loads, overruns, and Type D traffic area. This guide specification is to be used in the preparation of project specifications in accordance with ER 1110-345-720.

1 GENERAL

NOTE: See Additional Note A.

1.1 REFERENCES

NOTE: Issue (date) of references included in project specifications need not be more current than provided by the latest change (Notice) to this guide specification.

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)

ASTM C 29	(1991a) Unit Weight and Voids in Aggregate
ASTM C 127	(1988; R 1993) Specific Gravity and Absorption of Course Aggregate
ASTM C 128	(1993) Specific Gravity and Absorption of Fine Aggregate

ASTM C 131	(1989) Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine
ASTM C 136	(1995a) Sieve Analysis of Fine and Coarse Aggregates
ASTM D 75	(1987; R 1992) Sampling Aggregates
ASTM D 422	(1963; R 1990) Particle-Size Analysis of Soils
ASTM D 1556	(1990) Density and Unit Weight of Soil in Place by the Sand-Cone Method
ASTM D 1557	(1991) Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu. ft. (2,700 kN-m/cu. m.))
ASTM D 2167	(1994) Density and Unit Weight of Soil in Place by the Rubber Balloon Method
ASTM D 2922	(1991) Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
ASTM D 4253	(1991) Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
ASTM D 4318	(1993) Liquid Limit, Plastic Limit, and Plasticity Index of Soils
ASTM D 4643	(1993) Determination of Water (Moisture) Content of Soil by the Microwave Oven Method
ASTM E 11	(1995) Wire-Cloth Sieves for Testing Purposes

OKLAHOMA DEPARTMENT OF TRANSPORTATION (ODOT)

ODOT Standard Specifications for Highway Construction, Edition of 1988 with 1991 Supplement

TEXAS STATE DEPARTMENT OF HIGHWAYS AND PUBLIC TRANSPORTATION (TSDHPT)

TSDHPT Standard Specifications for Construction of Highways, Streets and Bridges, 1982]

1.2 DEFINITIONS

1.2.1 Aggregate Base

Aggregate base as used herein is well graded, durable aggregate uniformly moistened and mechanically stabilized by compaction.

1.2.2 Degree of Compaction

Degree of compaction is a percentage of the maximum laboratory dry density obtained by the test procedure presented in ASTM D 1557 or ASTM D 4253. ASTM D 1557 shall be used for soils containing 15 percent or more passing the no. 200 sieve (fines). ASTM D 4253 shall be used for soils containing 5

percent or less fines. The maximum laboratory dry density for soils containing between 5 and 15 percent fines shall be determined by the above procedure yielding the highest laboratory dry density. The percentage of material passing the no. 200 sieve shall be determined in accordance with **ASTM D 422**. Degree of compaction shall be expressed as a percentage of the maximum laboratory dry density obtained by the appropriate procedure as defined above. Percentage of maximum laboratory dry density has been abbreviated hereinafter as percent laboratory maximum density.

1.3 GENERAL

The work specified herein consists of the construction of an aggregate base course. The work shall be performed in accordance with this specification and shall conform to the lines, grades, notes and typical sections shown in the plans. Sources of all materials shall be selected well in advance of the time that materials will be required in the work.

1.4 SUBMITTALS

NOTE: Submittals must be limited to those necessary for adequate quality control. The importance of an item in the project should be one of the primary factors in determining if a submittal for the item should be required.

Indicate submittal classification in the blank space using "GA" when the submittal requires Government approval or "FIO" when the submittal is for information only.

Government approval is required for submittals with a "GA" designation; submittals having an "FIO" designation are for information only. The following shall be submitted in accordance with Section **01300** SUBMITTAL DESCRIPTIONS:

SD-01 Data

Plant, Equipment, Machines, and Tools; FIO.

List of proposed equipment to be used in performance of construction work including descriptive data.

SD-09 Reports

Sampling and Testing; FIO. Field Density; FIO.

Calibration curves and related test results prior to using the device or equipment being calibrated. Copies of field test results within 24 hours after the tests are performed. Certified copies of test results for approval not less than 30 days before material is required for the work.

SD-18 Records

Coarse Aggregate; FIO.

A notification stating which type of coarse aggregate is to be used.

1.5 WEATHER LIMITATIONS

Base shall not be constructed when the atmospheric temperature is less than 2 degrees C 35 degrees F. Base shall not be constructed on subgrades that are frozen or contain frost. If the temperature falls below 2 degrees C 35 degrees F, completed areas shall be protected against any detrimental effects of freezing.

1.6 PLANT, EQUIPMENT, MACHINES, AND TOOLS

1.6.1 General Requirements

Plant, equipment, machines, and tools used in the work shall be subject to approval and shall be maintained in satisfactory working condition at all times. Other compacting equipment may be used in lieu of that specified, where it can be demonstrated that the results are equivalent. The equipment shall be adequate and have the capability of producing the results specified.

1.6.2 Steel-Wheeled Rollers

Steel-wheeled rollers shall be the self-propelled type weighing not less than 10 metric tons tons, with a minimum weight of 136 kg per 13 mm 300 pounds per inch width of rear wheel. Wheels of the rollers shall be equipped with adjustable scrapers. The use of vibratory rollers is optional.

1.6.3 Pneumatic-Tired Rollers

**NOTE: Types of equipment specified but not required
in this type of base course will be deleted, and other
items of equipment not listed will be added as
appropriate.**

Pneumatic-tired rollers shall have four or more tires, each loaded to a minimum of 9,000 kg 20,000 pounds and inflated to a minimum pressure of 0.62 MPa 90 psi. The loading shall be equally distributed to all wheels, and the tires shall be uniformly inflated. Towing equipment shall also be pneumatic-tired.

1.6.4 Mechanical Spreader

Mechanical spreader shall be self-propelled or attached to a propelling unit capable of moving the spreader and material truck. The device shall be steerable and shall have variable speeds forward and reverse. The spreader and propelling unit shall be carried on tracks, rubber tires, or drum-type steel rollers that will not disturb the underlying material. The spreader shall contain a hopper, an adjustable screed, and outboard bumper rolls and be designed to have a uniform, steady flow of material from the hopper. The spreader shall be capable of laying material without segregation across the full width of the lane to a uniform thickness and to a uniform loose density so that when compacted, the layer or layers shall conform to thickness and grade requirements indicated. The Contracting Officer may require a

demonstration of the spreader prior to approving use in performance of the work.

1.6.5 Sprinkling Equipment

Sprinkling equipment shall consist of tank trucks, pressure distributors, or other approved equipment designed to apply controlled quantities of water uniformly over variable widths of surface.

1.6.6 Tamperers

Tampers shall be of an approved mechanical type, operated by either pneumatic pressure or internal combustion, and shall have sufficient weight and striking power to produce the compaction required.

1.6.7 Straightedge

The Contractor shall furnish and maintain at the site, in good condition, one 3.05 m 10-foot straightedge for each bituminous paver, for use in the testing of the finished surface. Straightedge shall be made available for Government use. Straightedges shall be constructed of aluminum or other lightweight metal and shall have blades of box or box-girder cross section with flat bottom reinforced to insure rigidity and accuracy. Straightedges shall have handles to facilitate movement on pavement.

1.7 STOCKPILING MATERIALS

Materials, including approved material available from excavation and grading, shall be stockpiled in the manner and at locations designated. Before stockpiling of material, storage sites shall be cleared, and sloped to drain. Materials obtained from different sources shall be stockpiled separately.

1.8 SAMPLING AND TESTING

1.8.1 General Requirements

**NOTE: Guidance for preparation of criteria to be used
in evaluating laboratory facilities is contained in
ASTM E 548.**

Sampling and testing shall be performed by an approved commercial testing laboratory or by facilities furnished by the Contractor. No work requiring testing shall be permitted until the facilities have been inspected and approved. The first inspection shall be at the expense of the Government. Cost incurred for any subsequent inspection required because of failure of the facilities to pass the first inspection will be charged to the Contractor. Tests shall be performed in sufficient numbers and at the locations and times directed to insure that materials and compaction meet specified requirements. Copies of test results shall be furnished to the Contracting Officer within 24 hours of completion of tests.

1.8.2 Test Results

Results shall verify that materials comply with this specification. When a material source is changed, the new material will be tested for compliance. When deficiencies are found, the initial analysis shall be repeated and the material already placed shall be retested to determine the extent of unacceptable material. All in-place unacceptable material shall be replaced or modified as directed by the Contracting Officer.

1.8.3 Sampling

Aggregate samples for laboratory tests shall be taken in accordance with [ASTM D 75](#).

1.8.4 Sieve Analysis

Before starting work, at least one sample of material shall be tested in accordance with [ASTM C 136](#) and [ASTM D 422](#) on sieves conforming to [ASTM E 11](#). After the initial test, a sieve analysis shall be performed on material from each sand cone test location.

1.8.5 Laboratory Density

Tests shall provide a moisture-density relationship for the aggregate. Tests shall be conducted in accordance with paragraph "Degree of Compaction" in Part 1 above.

1.8.6 Weight Per Cubic Meter Foot of Slag

Weight per cubic meter foot of slag shall be determined in accordance with [ASTM C 29](#).

1.8.7 Optimum Moisture and Laboratory Maximum Dry Density

The laboratory maximum dry density shall be determined from materials obtained at a sand cone test location using the appropriate procedure specified in Part 1 above. When [ASTM D 1557](#) is used, the optimum moisture content shall be determined. A minimum of one laboratory maximum dry density test shall be run each placement day or fraction thereof. Additional laboratory maximum dry density tests shall be run for each material change.

2 PRODUCTS

2.1 MATERIALS

2.1.1 Aggregates

Aggregates shall conform to [ODOT Standard Specifications](#) for Highway Construction, Section 703.01, Type A gradation. Aggregates shall conform to [TSDHPT Standard Specifications](#) for Construction of Highways, Streets and Bridges, 1982, Item 247, Type A, Grade 1.

3 EXECUTION

3.1 GENERAL REQUIREMENTS

When the base is constructed in more than one layer, the previously constructed layer shall be cleaned of loose and foreign matter by sweeping with power sweepers or power brooms, except that hand brooms may be used in areas where power cleaning is not practicable. Adequate drainage shall be

provided during the entire period of construction to prevent water from collecting or standing on the working area. Line and grade stakes shall be provided as necessary for control. Grade stakes shall be in lines parallel to the centerline of the area under construction and suitably spaced for string lining.

3.2 OPERATION OF AGGREGATE SOURCES

NOTE: Investigate the availability of Government-owned aggregate source that meets the specification requirement. If none is available, delete material in the first set of brackets.

Aggregates shall be obtained from off-site sources.

3.3 PREPARATION OF UNDERLYING COURSE

NOTE: Reference to the applicable specification section will be retained. Proper compaction of cohesionless materials may be obtained by other methods based on local experience.

3.3.1 General Requirements

Before constructing aggregate base course, the previously constructed underlying course shall be cleaned of foreign substances. Surface of underlying course shall meet the specified compaction and surface tolerances. Subgrade shall conform to Section 02240 LIME MODIFIED SUBGRADE and Section 02225 EARTHWORK FOR ROADWAYS AND PARKING AREAS. Ruts or soft, yielding spots that may appear in the underlying course, areas having inadequate compaction, and deviations of the surface from requirements specified shall be corrected. For cohesionless underlying materials containing sands, sand gravels, or any other cohesionless material in harmful quantities, the surface shall be mechanically stabilized with aggregate prior to placement of the aggregate course. Stabilization may be accomplished by mixing base course material into the underlying course and compacting by approved methods. Properly compacted material will be considered as part of the underlying course and shall meet all requirements for the underlying course. Finished underlying course shall not be disturbed by traffic or other operations and shall be maintained in a satisfactory condition until base course is placed.

3.3.2 Grade Control

Underlying material shall be excavated to sufficient depth for the required base course thickness so that the finished base course with the subsequent surface course will meet the fixed grade. Finished and completed area shall conform to the lines, grades, cross section, and dimensions indicated.

3.4 INSTALLATION

3.4.1 Mixing and Placing

**NOTE: More details of mixing methods will be included
if applicable.**

Materials shall be mixed by the stationary plant, traveling plant, or road mix method and placed in such a manner as to obtain uniformity of the aggregate base course material and at a uniform optimum water content for compaction. The Contractor shall make such adjustments in mixing or placing procedures or in equipment to obtain the true grades, to minimize segregation and degradation, to reduce or accelerate loss or increase of water, and to ensure a satisfactory base course.

3.4.2 Edges of Base Course

Approved material shall be placed along edges of aggregate base course in such quantities as will compact to thickness of the course being constructed, or to the thickness of each layer in a multiple layer course, allowing in each operation at least a 1-foot width of the shoulder to be rolled and compacted simultaneously with rolling and compacting of each layer of base course.

3.4.3 Compaction

NOTE: Appropriate percentage will be inserted.

Each layer of aggregate base course shall be compacted. Water content shall be maintained at optimum. Density of compacted mixture shall be at least 100 percent of laboratory maximum density. Rolling shall begin at the outside edge of the surface and proceed to the center, overlapping on successive trips at least one-half the width of the roller. Alternate trips of the roller shall be slightly different lengths. Speed of the roller shall be such that displacement of the aggregate does not occur. Areas inaccessible to the rollers shall be compacted with mechanical tampers, and shall be shaped and finished by hand methods.

3.4.4 Layer Thickness

Compacted thickness of the aggregate course shall be as indicated. No layer shall be in excess of 200 mm 8 inches nor less than 75 mm 3 inches in compacted thickness.

3.4.5 Finishing

The surface of the top layer shall be finished to grade and cross section shown. Finished surface shall be of uniform texture. Light blading during compaction may be necessary for the finished surface to conform to the lines, grades, and cross sections. Should the surface for any reason become

rough, corrugated, uneven in texture, or traffic marked prior to completion, such unsatisfactory portion shall be scarified, reworked, recompact, or replaced as directed.

3.4.5.1 Smoothness

Surface of each layer shall show no deviations in excess of 9 mm 3/8 inch when tested with the 3.05-meter 10-foot straightedge. Deviations exceeding this amount shall be corrected by removing material and replacing with new material, or by reworking existing material and compacting, as directed.

3.4.5.2 Thickness Control

NOTE: See Additional Note E.

Compacted thickness of the base course shall be within 13 mm 1/2 inch of the thickness indicated. Where the measured thickness is more than 13 mm 1/2 inch deficient, such areas shall be corrected by scarifying, adding new material of proper gradation, reblading, and recompact as directed. Where the measured thickness is more than 13 mm 1/2 inch thicker than indicated, the course shall be considered as conforming to the specified thickness requirements. Average job thickness shall be the average of all thickness measurements taken for the job, but shall be within 7 mm 1/4 inch of the thickness indicated.

3.5 FIELD QUALITY CONTROL

3.5.1 Field Density

A sufficient quantity of material shall be obtained from the sand cone test location to determine the maximum laboratory dry density, gradation, liquid limit, and plastic limit. A gradation test shall be run on the sample prior to determining the maximum laboratory dry density. A portion of the sampled material passing the no. 40 sieve shall be tested to determine the liquid limit and plasticity index. Additional tests shall be run for each material change.

3.5.2 Field Density and Moisture Content

Field in-place density shall be determined in accordance with ASTM D 1556 \ or ASTM D 2922. If ASTM D 2922 is used, in-place densities shall be checked by ASTM D 1556 at least once per each 8 nuclear density tests and at least once per each lift placed. The sand cone test shall be performed adjacent to the location where a nuclear density test was taken to ensure a proper correlation is established between the two methods. Moisture contents shall be determined in accordance with ASTM D 4643 or ASTM D 2216. If ASTM D 4643 is used, moisture contents shall be checked by ASTM D 2216 once per each ten microwave tests. The laboratory tests specified in Part 1 of this section shall be run on materials obtained from a sand cone test sample location. At least one field density and one moisture content test shall be performed for each 836 square meters 1,000 square yards of each layer of stabilized aggregate base material placed.

3.5.3 Smoothness

Measurements for deviation from grade and cross section shown shall be taken in successive positions parallel to the road centerline with a 3 m 10 foot straightedge. Measurements shall also be taken perpendicular to the road centerline at 15 meter 50 foot intervals.

3.5.4 Thickness

Thickness of the base course shall be measured at intervals in such a manner as to ensure one measurement for each 836 square meters 1,000 square yards of base course. Measurements shall be made in 75 mm 3-inch diameter test holes penetrating the base course.

3.6 TRAFFIC

Completed portions of the area may be opened to traffic, provided there is no marring or distorting of the surface by the traffic. Heavy equipment shall not be permitted except when necessary to construction, and then the area shall be protected against marring or damage to the completed work.

3.7 MAINTENANCE

The aggregate base course shall be maintained in a satisfactory condition until accepted. Maintenance shall include immediate repairs to any defects and shall be repeated as often as necessary to keep the area intact.

3.8 DISPOSAL OF UNSATISFACTORY MATERIALS

Removed in-place materials that are unsuitable for the base course material that is removed for the required correction of defective areas, and waste material and debris shall be disposed of off site at the Contractor's responsibility.

ADDITIONAL NOTES

NOTE A: For additional information on the use of all CEGS, see CEGS-01000 CEGS GENERAL NOTES.

NOTE B: Materials requirement from State or other local highway agency specifications may be incorporated in contract documents for constructing aggregate base course for roads, streets, or similar-use pavements if the following conditions are met:

a. Percentage of material by weight passing the No. 200 sieve shall not exceed 10.

b. Where local conditions dictate a non-frost-susceptible material, particles having a diameter of less than 0.02 millimeter shall not exceed 3 percent.

c. Portion of the material passing the No. 40 (425 micron) sieve shall have a liquid limit not greater than 25 and a plasticity index not greater than 5.

d. State or other local highway specifications selected for projects requiring not more than 750 cubic yards of material must be approved by the Division Engineer.

e. State or other local highway specifications selected for projects requiring more than 750 cubic yards must be approved by the Chief of Engineers prior to incorporation in the contract documents. A copy of the specifications or proper reference thereto and information regarding traffic conditions and facilities to be paved will be submitted to the HQDA (CEMP-ET), with the request for approval.

f. Rounded aggregates (such as river-run gravel) generally will not be allowed since they do not provide sufficient interlocking action to produce the desired compaction.

NOTE C: Desired gradation size and maximum aggregate size will be selected. On the basis of local conditions, the percentage passing the No. 200 sieve may be further restricted to help control the amount of particles having diameters less than 0.02 millimeter. The frost susceptibility requirement will be deleted in areas where the material is not subject to frost action.

NOTE D: Drawings should be checked to ensure that any supplementary information required by the paragraph has been shown and that there is no conflict between the drawings and the specifications.

When aggregate base course is used in medium-load airfield runway pavement construction, this paragraph will be retained; when used otherwise, references to proof rolling will be deleted unless it is specifically required by the design engineer.

NOTE E: When aggregate base courses are constructed less than 6 inches in total thickness, a deficiency of 1/2 inch in thickness of any area of such paving is considered excessive. Applicable to job conditions, the thickness-tolerance provisions may be modified as required, restricting all deficiencies to not over 1/4 inch.
